

REMARKS

Reconsideration of the application is respectfully requested.

I. Status of the Application

Claims 1-4 and 6-11 are currently pending.

Claim 5 was previously canceled without prejudice or disclaimer.

Claims 10 and 11 are amended. No new matter is added.

II. Rejections under 35 U.S.C. §112

The rejection of claims 10 and 11 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention is noted. Claim 10 is amended to more clearly define the structure of “element mounting member.” Claim 11 is amended to more positively recite that the output is of the semiconductor light-emitting element.

III. Rejections under 35 U.S.C. §103

The rejection of claims 1-4, 6, 9, and 10 under 35 U.S.C. §103(a) as being unpatentable over JP-2003-209286 by Kitano (“Kitano”) in view of Silicon Processing for VLSI Era Volume 1 by Wolf et al. (“Wolf”), is traversed. Kitano discloses in FIG. 3 and on pages 8 and 9 of the translation, a substrate 111 on top of which are layers 1, 2, 3, and 4 as follows:

layer 1- a layer of Cu 110 with a thickness of 18-70 micrometers;

layer 2- a layer of nickel 109 of 4.0 micrometers;

layer 3- Au layer 108 with a thickness of 0.3 – 2.0 micrometers; and

layer 4- an Ag layer 107 with a thickness of 5.0 micrometers.

The Ag layer 107 is the reflective surface.

Thus, Kitano discloses a substrate where the top layer of Ag, the reflecting layer, has a thickness of 5.0 micrometers. In Applicants' invention, the layer of Ag formed on the surface of the substrate is positively recited as having a thickness of 0.5 – 3 micrometers, not 5.0 micrometers as is disclosed by Kitano.

The Examiner states that Wolf teaches Applicants' crystal grains diameter because it describes that "smaller grains are the result of higher deposition rates." This is contrary to what Wolf states. Wolf states on page 106, last line, that "[l]arger grains are expected for increased substrate ... temperatures as a result of the increased surface mobility" and on page 107 lines 5-6 that "[f]or high deposition rates, the heat of condensation can raise the substrate temperature (thereby producing increased grain size from thermal effects)." (underscoring added for emphasis).

Claim 1 recites the structure of : "a substrate" and "a metal film formed on a surface of said substrate, formed from Ag ... and functioning as an electrode layer ... and a reflective layer for reflecting light from a semiconductor light-emitting element" in combination with the metal film having a thickness of "... 0.5 - 3 μm and crystal grains of said metal or alloy forming said metal film have a particle diameter along a surface plane of said metal film is no more than 0.5 μm and said surface of said metal film has a center-line average roughness Ra of no more than 0.1 μm ."

Clearly, neither Kitano nor Wolf, either separately or combined, disclose or suggest doing what the Applicants disclose and positively recite as their invention in claim 1, that being: a substrate with a metal film of Ag, Al, or an alloy containing said metal formed on a surface of the

substrate and functioning as a reflective layer, where the thickness of the metal film is 0.5-3 µm, the crystal grains of the metal film have a particle diameter that is no more than 0.5 µm and the surface of the metal film has a center-line roughness Ra of no more than 0.1 µm. (underscoring added for emphasis). Therefore, it is our understanding that claim 1 is in condition for allowance.

It is noted that it is only after the Examiner has read and fully understood what Applicants have done that, with improper hindsight, he has attempted to combine the disclosures of Wolf with Kitano to do what Applicants now claim as their invention. It is also noted that the combination of Wolf with Kitano would still not disclose the structure that Applicants recite in claim 1. Claims 2-4, 6, 9, and 10 depend from claim 1 and, therefore, for the reasons noted above, also are in condition for allowance.

With the invention disclosed and claimed by the Applicants, the smoothness of the surface of the metal film is improved. More specifically, based on the shape of the individual crystal grains of the metal or alloy film on the substrate, large crystal grain particle diameters on the surface tend to increase unevenness of the surface. Also, the surface shape of the metal film is influenced by the surface shape of the underlying substrate, and greater surface roughness of the substrate tends to increase unevenness of the metal film surface. As the unevenness of the metal film surface increases, the increase in roughness will cause a decrease in its reflectivity.

Claim 1 recites that the individual crystal grains of the metal film have a particle diameter of no more than 0.5 µm along the plane of the metal film. This minimizes the unevenness of the metal film surface based on the shape of the portions exposed on the surface of the metal film. Also, by adjusting the substrate surface shape to set the center-line average roughness Ra of the metal film

surface to no more than 0.1 μm , the smoothness of the metal film surface can be improved and light reflectivity can be improved.

In Applicants' invention and as recited in claim 1, in addition to providing smooth surfaces to the metal films 11, 12, the center-line average roughness Ra is defined as being no more than 0.1 μm . Wolf is silent about surface roughness.

IV. Rejections under 35 U.S.C. §103

The rejection of claims 7 and 8 under 35 U.S.C. §103(a) as being unpatentable over Kitano in view of Wolf, and further in view of US Patent Publication 2004/0026708 to Chen is traversed. Claims 7 and 8 depend from claim 1 and, therefore, for the reasons noted above, claims 7 and 8 are also believed to be in condition for allowance.

V. Rejections under 35 U.S.C. §103

The rejection of claim 11 under 35 U.S.C. §103(a) as being unpatentable over Kitano in view of Wolf, and further in view of (US Patent Publication 2004/0004435) to Hsu is traversed. Claim 11 depends from claim 1 and, therefore, for the reasons noted above, claim 11 is also believed to be in condition for allowance.

VI. Rejections under 35 U.S.C. §103

The rejection of claims 1-4, 6, 9, and 10 under 35 U.S.C. §103(a) as being unpatentable over Wolf, in view of Kitano is traversed. Wolf is solely directed to the fabrication of

VLSI and ULSI devices. These structures are integrated circuits which have small line width and high densities. As stated on page 104, lines 11-12, “[t]hese small geometries also create highly rugged topography for overlaying films to cover.” Rugged is defined as “[h]aving a rough, uneven surface; not smooth.” Thus, using the teachings of Wolf may not result in a metalized surface which is sufficiently smooth for reflecting light. Continuing, the Examiner states that Wolf discloses a metal film having a center-line average roughness Ra of no more than 0.1 μm . A careful reading of Wolf failed to disclose where this information is disclosed. The Examiner states again that smaller grains are the result of higher deposition rates. As noted above, this is contrary to what is disclosed in Wolf. Also, Wolf is VLSI and ULSI devices true dimensions that are too small to be coupled to a semiconductor light-emitting element. The conductive traces of these devices are not sized to carry the current needed for an attached semiconductor light-emitting element to operate.

The Examiner states that Kitano teaches, in FIG. 3 and related text, an adhesion (110) and a barrier layer (109) are formed, in sequence, on said substrate, with said metal film being formed on said barrier layer. Claim 1 recites that the metal film is formed on a surface of the substrate. Clearly, therefore, claim 1 avoids Kitano. For the reasons noted above for the various rejections, it is Applicants understanding that claims 1-4, 6, 9, and 10 are in condition for allowance.

Repeating, and as noted at the beginning, the references cited, either separately or combined, do not disclose or suggest the structure of claim 1, that being: a substrate with a metal film of Ag, Al, or an alloy containing said metal formed on a surface of the substrate and functioning as a reflective layer, where the thickness of the metal film is 0.5-3 μm , the crystal grains

of the metal film have a particle diameter that is no more than 0.5 μm , and the surface of the metal film has a center-line roughness Ra of no more than 0.1 μm . (underscoring added for emphasis).

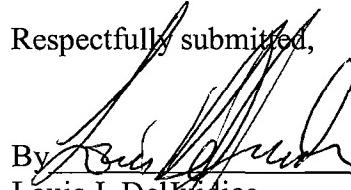
CONCLUSION

In view of the above, each of the presently pending independent Claims 1-4 and 6-11 in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

The Examiner is respectfully requested to contact the undersigned at the telephone number indicated below if the Examiner believes any issue can be resolved through either a Supplemental Response or an Examiner's Amendment.

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Respectfully submitted,

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